Small Business Innovation Research/Small Business Tech Transfer

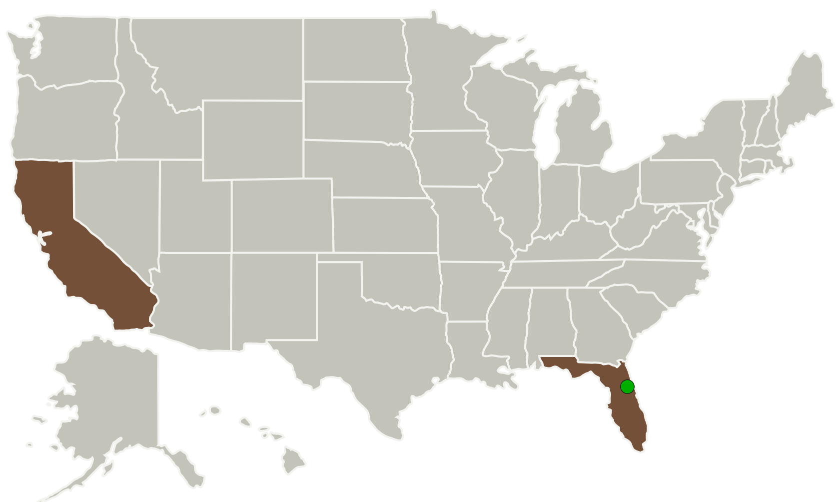
Microplate Heat Exchanger, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

We propose a microplate heat exchanger for cryogenic cooling systems used for continuous flow distributed cooling systems, large focal plane arrays, multiple cooling locations, and very low vibration cooling systems. Any DC cryogenic flow system such as turbo Brayton, Joule-Thomson (JT), or remote cooling applications require very high effectiveness heat exchangers to reduce input power. The parasitic loads from heat exchangers are a significant fraction of the overall load, and high effectiveness heat exchangers lead directly to improved system efficiencies across a broad range of cryogenic applications. Microplate heat exchangers have a demonstrated effectiveness over 98% (Marquardt, Cryocoolers 15). While performance is high, they will be difficult to use for larger cryogenic flow systems due to parasitic conduction losses inherent in the materials available for the manufacturing process. A material change will allow more compact heat exchangers with lower parasitic losses. Other limitations of the manufacturing process make yields low, and while it may be possible to push the effectiveness higher, it may be difficult to consistently produce high performing exchangers using the current approach. We propose a new bi-metal microplate heat exchanger which is unique in that it uses the manufacturing process to control critical heat exchanger dimensions that are inherently similar across all parts, allowing high effectiveness without the need for close inspection of every part and the low yield which results from hand inspection. We further include additional features within the flow channels that automatically balance the mass flows within the heat exchanger to push the effectiveness even higher. This is accomplished in the most compact cryogenic heat exchangers theoretically possible to build using parallel plate flow channels.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Micro Cooling Concepts, Inc.	Lead Organization	Industry Veteran-Owned Small Business (VOSB)	Huntington Beach, California
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
California	Florida

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/139226)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Micro Cooling Concepts, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

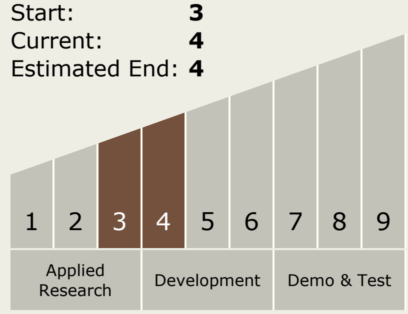
Carlos Torrez

Principal Investigator:

Jack M Fryer

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  └─ TX14.2 Thermal Control Components and Systems
    └─ TX14.2.1 Heat Acquisition

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System